Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of:	)	
	)	ET Docket No. 02-135
Spectrum Policy Task Force Seeks	)	
Public Comment on Issues Related to	)	
Commission's Spectrum Policies	)	

REPLY COMMENTS OF HUGHES NETWORK SYSTEMS, INC.

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Hughes Network Systems, Inc. ("Hughes") submits these Reply Comments in response to the Comments filed on the Commission's June 6, 2002 Public Notice seeking input on current and future policies related to spectrum use and allocations. Hughes offers the following views from its perspective as a licensee of satellite networks in the Fixed Satellite Service (FSS), and as a leading manufacturer and operator of very small aperture earth terminal (VSAT) networks that operate in the FSS bands.

The record created in response to the Public Notice has been tremendous—more than 135 comments have been filed. With this in mind, Hughes' Reply Comments focus on four key issues: (i) why the fixed satellite service (FSS) should have access to its own spectrum, free from terrestrial interference, (ii) the need to avoid quantifying "harmful interference" in a way that constrains the development of technology, (iii) the need for unlicensed users to have access to their own spectrum bands, separate and apart from the FSS bands, and (iv) why the Commission should take a long term view with respect to its satellite spectrum allocation and licensing decisions.

I. THE FIXED SATELLITE SERVICE NEEDS ITS OWN SPECTRUM

A number of commenters have addressed the difficult issues presented by allowing multiple services to share access to common spectrum, whether on a licensed or unlicensed basis.[1] Cingular Wireless aptly describes the difficulty with sharing among different services employing diverse technologies, and concludes that forced spectrum sharing between different services operated by different operators can ultimately lead to less efficient use of available bandwidth.[2] The SIA urges the Commission to exercise extreme caution before it considers allowing the use of satellite-bands by terrestrial or other unlicensed users, noting a variety of concerns about adequately protecting satellite users from interference.[3] Hughes believes that these concerns are particularly applicable to the FSS and offers the following further views on the technological and other problems presented by requiring the FSS to share spectrum with terrestrial users.

Issues of terrestrial/satellite spectrum sharing are particularly acute in the FSS bands because of the way that FSS spectrum is shared on a co-channel basis among multiple satellite systems. Under longstanding Commission policies, dozens of satellite networks, spaced two degrees away from each other, are able to serve the United States, reusing the same frequency bands. This means that any attempt by one entity to implement a terrestrial network in an FSS band has the potential to create harmful interference into a large number of satellite systems operated by other entities. For this reason, the FSS situation stands in contrast with the

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1 *See, e.g., Comments of BellSouth Corporation* at 6, ET Docket No. 02-135, July 8, 2002; *Comments of XtremeSpectrum, Inc.* at 6, ET Docket No. 02-135, July 8, 2002; and *Comments of the Satellite Industry Association* at 9, ET Docket No. 02-135, July 8, 2002 (*"SIA Comments"*).

2 *Comments of Cingular Wireless LLC* at 19, ET Docket No. 02-135, July 8, 2002 (*"Cingular Comments"*).

3 *SIA Comments* at 9.

case of SDARS and certain MSS bands where satellite licensees have an exclusive assignment of spectrum (sometimes around the world), and do not share spectrum on a co-frequency basis with other satellite systems. Thus, in those cases, it may be possible for a satellite licensee to implement a terrestrial component to its network that is not expected to adversely affect other satellite users of the same frequency band.

A. FSS Systems Require Adequate Protection from Interference Caused By Terrestrial Sources.

Cingular correctly notes that there are significant technological differences between terrestrial services, on the one hand, and certain satellite services, on the other hand, that the Commission needs to take into account in its spectrum policy considerations.[4] These fundamental differences make it impractical to require FSS systems to share the same spectrum with terrestrial users without unduly constraining the development of the FSS.

Terrestrial services can interfere with FSS operations in one of two ways. The first way is that signals from terrestrial transmitters can generate signals in the direction of the spacecraft and interfere with receivers on board the spacecraft. The second way is that signals emitted from terrestrial transmitters can interfere with the reception of signals by satellite earth station receivers operating in the same geographic area.

The potential for terrestrial interference into FSS spacecraft is a particular concern in the case of large numbers of terrestrial transmitters, such as LMDS or the 39 GHz broadband services deployed by companies such as Winstar. The basic problem is that these types of services employ large numbers of transmitting stations that operate over a large range of azimuth and elevation angles that can cause interference into in-orbit spacecraft, and there is no realistic, enforceable way to limit the aggregate level of interference generated by these terrestrial users

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[4] *Cingular Comments* at 11.

toward the spacecraft. While the concept of an aggregate power limit on terrestrial users sometimes is considered as a way to address this problem, this would present a number of problems.

First, mandating that an FSS satellite system accept a certain level of "noise" from terrestrial operations, based on the state of today's satellite technology, constrains the deployment of more advanced satellite technology. For example, it could preclude the development of more "sensitive" receivers on board spacecraft that would allow the use of smaller, lower-powered, lower-cost earth terminals.

Second, aggregate power levels would be difficult, if not impossible, to enforce against the many potential terrestrial users within the coverage beam of an FSS satellite, which typically includes nations other than the United States. As an initial matter, it is difficult to apportion an aggregate power level among multiple terrestrial users. This is a very real practical problem whether one is dealing with multiple terrestrial users within the U.S., or whether one is dealing with a single nationwide user in the U.S. and terrestrial users in Canada and Mexico that are within the spacecraft coverage beam.

Even if one could practically apportion an aggregate power limit among the multiple terrestrial users, it would be virtually impossible for an FSS spacecraft operator to identify which terrestrial user causes the aggregate power limit to be exceeded. And the FSS satellite operator could well find itself faced with the impossibility of proving that the interference suffered by the satellite system was not caused by a problem other than the alleged violation of an aggregate power level. These aggregate power issues reflect an intractable

problem that both satellite and terrestrial industries previously recognized is a barrier to sharing between the FSS and broadly deployed terrestrial services.[5]

With respect to the potential for terrestrial interference into satellite earth terminal receivers, it is important for the Commission to take into account that satellite networks are designed differently than terrestrial networks, and these differences have a significant effect on the potential for spectrum sharing between the FSS networks and terrestrial networks.

As noted in Hughes' Comments, spacecraft are very expensive to construct and launch, and need to generate on-board all of the power that they use to operate.[6] For these and other reasons, satellite engineers go to great lengths to efficiently use every watt of available power on a spacecraft. Likewise, satellite receive earth terminals are designed, by necessity, to be sensitive enough to capture the relatively low-powered signals they receive from distant spacecraft—located 22,300 miles away in the case of geostationary-orbit spacecraft. The same sensitivity that allows these receivers to capture satellite transmissions emanating from space makes these receivers susceptible to interfering emissions from terrestrial transmitters.

In contrast, terrestrial transmitters typically are not constrained by power or weight limitations. It is relatively inexpensive for a terrestrial network to use larger transmitting amplifiers, generate high-powered signals, or install additional transmitters in areas where signal coverage issues exist. For this reason, terrestrial network operators have a natural incentive to design their systems to operate at a sufficiently high power level in order that they can overcome virtually any signal attenuation problem. The net result is that in most situations where FSS and

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5 *See, e.g., Report of the LMDS/FSS 28 GHz Negotiated Rulemaking Committee* at ii & 90 (September 23, 1994), CC Docket 92-297 (industry unable to develop regulations that feasibly could be enforced in order to regulate aggregate interference into satellite receive beams caused by large numbers of terrestrial transmitters).

6 *Comments of Hughes Network Systems, Inc.* at 5, ET Docket No. 02-135, July 8, 2002 ("*Hughes Comments*").

terrestrial sharing is considered, the satellite signals received at the earth's surface will be relatively faint, as compared with terrestrial signals that are emitted from transmitters operating in the same geographic area as the satellite earth terminal receivers.

These differences lead to a number of sharing problems that are particularly acute for FSS systems. First, satellite earth terminal receivers are very sensitive to interference from nearby, high-powered terrestrial transmitters. Requiring satellite earth terminal receivers and terrestrial transmitters to operate in the same band therefore can result in large "exclusion areas" surrounding terrestrial transmitters where co-frequency geographic sharing with satellite earth terminal receivers is not possible. Similarly, satellite earth terminal receivers are susceptible to interference caused by out-of-band emissions from nearby, high-powered terrestrial transmitters in adjacent bands.

While it may be possible to limit terrestrial deployment (e.g., power levels, geographic density, pointing restrictions, etc.) in such a way as theoretically not to cause interference into today's satellite earth terminal receivers, doing so would constrain the development of satellite technology. For example, a terrestrial power level intended to protect a satellite link designed for a certain carrier and using a particular earth terminal antenna size, might not protect a different satellite carrier, or a smaller antenna size, used in the future.

It is impossible for industry or the Commission to accurately predict or to foresee the likely development of satellite technology or new applications for that technology. The Commission, however, had the wisdom over twenty years ago to set aside the Ku band at 11.7-12.2 GHz and 14.0-14.5 GHz for the FSS, and to exclude co-primary terrestrial uses of those bands. That action has facilitated the development of the vibrant VSAT industry on which countless Americans rely every day. Twenty years ago, no one realistically could have predicted

that technology would advance to the point that 74 cm Ku band antennas could operate in a two-degree spacing environment and support the provision of high-speed broadband services by satellite to virtually anyone in the United States. Indeed, even 1.2-meter Ku band antennas were not routinely licensed by the Commission until 1986. Today's 74 cm antennas are now at a small enough size to be attractive for deployment to residences and many small businesses.

The ability for satellite operators to deploy sub-one-meter antennas at Ku band has occurred, in part, because satellite technology was not constrained by the need to co-exist with terrestrial operators. Future technological advances might provide a whole new range of satellite services or open satellite service availability to a whole new category of uses. As a matter of spectrum policy, such possibilities should not be preempted by the development of satellite/terrestrial sharing criteria based on today's technology.

In sum, due to the way that multiple FSS networks share spectrum on a co-frequency basis, Cingular is correct that there are some very different technical characteristics that affect the potential for sharing between the FSS and terrestrial services. Sharing between such very different services results in large costs and creates inefficiencies.

B. Mandating FSS and Terrestrial Sharing Increases Costs And Inefficiencies.

Hughes endorses the concerns expressed by Sprint and Cingular that adding additional licensees to, or allowing unlicensed use of, a given spectrum band creates a number of uncertainties. Sprint aptly expresses concern about "overlaying" a new service on an incumbent licensed service, and the chilling effect doing so would have on innovation by the current licensees: "If operators must account for the possibility that some unknown new interference

level may be introduced at some time in the future, they must necessarily incorporate some unused margin in their interference budgets, which will result in a sub-optimum design."[7]

Cingular sums up the issue quite nicely by challenging the assumption made by some that it is optimal to facilitate shared use of a band by different licensees operating different services. As Cingular states: "In fact, shared use may encourage inefficiency. Under a regime where two different services share spectrum, licensees in one service have no incentive to implement new, efficient technologies that will reduce the amount of spectrum they need vis-à-vis the other service, or others because their service will not benefit from the efficiency. Instead, the other service sharing access to the spectrum would benefit at no cost."[8]

In Hughes' view, requiring sharing between the FSS and terrestrial users would come with significant costs and lost efficiencies on the part of satellite systems. Specifically, sharing between the FSS and terrestrial users typically requires the satellite operators to coordinate with terrestrial users of separate networks prior to deploying satellite earth stations, and, as noted above, typically results in areas—"exclusion zones"—where satellite service is precluded by terrestrial use of another licensee or operator. This imposes substantial costs on the satellite operator, precludes the deployment of certain satellite services, including those with ubiquitous satellite terminals, and precludes the provision of satellite service in many urban and suburban areas.

Requiring that a satellite operator coordinate with the terrestrial users of another licensee or operator, prior to deploying a satellite terminal, creates a number of costs and inefficiencies. First, it requires site-specific technical analyses and coordination studies before the satellite service can be deployed to a given customer. The requirement to conduct these

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7 *Comments of Sprint Corporation* at 20, ET Docket No. 02-135, July 8, 2002.

8 *Cingular Comments* at 19.

analyses and studies creates some practical problems, which are of particular concern in the case of a satellite service designed to be deployed to consumers on a mass-market basis: (i) it delays the ability to roll-out service to that customer, as compared to the time it takes a competing service provider—such as a cable broadband or DSL service—to commence service; and (ii) it significantly increases the cost of acquiring that customer—and creates a cost that a competing cable broadband or DSL provider does not bear.

More fundamentally, the prior deployment of terrestrial service in a given area can result in satellite service simply not being available for the potential satellite customer at all. Terrestrial wireless services historically are deployed first in high-density business and population centers. Should terrestrial technology be commercially available for a given frequency band before satellite technology, terrestrial use of a band can result in large geographic areas, in urban or suburban areas, where interference considerations preclude the subsequent ability to deploy satellite terminals. Thus, requiring prior coordination can preclude the ubiquitous deployment of satellite terminals.

Some may argue that this dynamic still leaves the rural areas for satellite service. It is true that an enormous benefit of satellite systems is the ability to serve areas that are unserved or underserved by terrestrial networks. But this does not mean that it is economically feasible to deploy a satellite service that does not have the ability to provide service in urban or suburban areas. To the contrary, access to urban and suburban areas is essential—those areas contain the potential markets of business users that justify the initial decision to deploy a satellite network. Hughes cannot overemphasize that it simply is not economical to launch an FSS satellite system to provide a mass-market service unless that system can predictably and reliably provide service to urban and suburban areas.

II. INTERFERENCE ISSUES

As a general matter, Hughes does not believe that the current definitions of "interference" or "harmful interference" in the Commission's rules need to be changed or quantified. Hughes agrees with the many commenters who warn the Commission against any attempt to specifically quantify these concepts.

Quantifying "harmful interference" requires that the Commission identify and take into account the many technical parameters of a potential interference victim's service—signal strength, equipment characteristics, data rate, service availability, among other factors. Many of these parameters, of course, are tied to the specific service being provided today. But service demands and technology change over time. Neither the high-data rates demanded by today's broadband consumers, nor the technology developments that allow the use of increasingly smaller satellite terminals, were even a glimmer in the Commission's eye a decade ago. Thus, any attempt to quantify the level of "harmful interference" that today's FSS systems services should be expected to suffer from terrestrial or unlicensed users, will, by necessity, have the unintended effect of freezing satellite technology in place and constraining future technological developments.

Xtreme Spectrum advocates the development of a quantified standard of "harmful interference" to facilitate the deployment of unlicensed devices.[9] For the reasons above, Hughes opposes any attempt to quantify the level of interference that Part 15 users may generate into licensed satellite services. As Sprint and Cingular appropriately advocate, unlicensed users simply should not be allowed to disrupt in any way the use of the same frequency band by primary, licensed users.

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[9] *Comments of XtremeSpectrum, Inc.* at 6, ET Docket No. 02-135, July 8, 2002 ("*Xtreme Comments*").

Hughes is very concerned that advocates for unlicensed devices seem to be pressing for redefinitions of "harmful interference" that would turn Part 15 on its head—they would allow unlicensed terrestrial users to cause far more interference into a satellite system than a satellite licensee typically would accept from a co-primary, satellite user of the same spectrum.

Instead of this approach, Hughes urges the Commission to consider a different way of redefining the relationship between licensed users and unlicensed users of the same frequency band. Currently, Part 15 unlicensed users are precluded from causing "harmful interference" into licensed users—interference that "endangers the functioning of a [safety service] or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service . . . ."[10] Some manufacturers of Part 15 devices have invoked this definition to advocate that short term, periodic interruptions into a licensed service, caused by Part 15 interference, do not rise to the level of "harmful interference" and therefore are not precluded by Part 15 rules. Moreover, this definition does not appear adequately to take into account the effect of interference that reduces the throughput, margins, or availability, of a licensed service, but does not, by itself, cause the licensed service to cease to operate. To address this harmful impact of interference, and in order to adequately protect the operations of licensed systems, Hughes recommends that the Commission adopt a lower interference threshold than "harmful interference" to define the permissible impact of Part 15 and other unlicensed devices. For example, such a definition could focus on the effect of interference on performance degradation to, or data misinterpretation and loss of information by, licensed users.

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[10] 47 C.F.R. § 15.3(m).

III. UNLICENSED DEVICES NEED THEIR OWN BANDS

Hughes agrees with those commenters who urge the Commission to provide designated frequency bands where unlicensed users can operate without posing a threat to incumbent users of the spectrum.[11] The types of unlicensed uses and devices being deployed and proposed today present a fundamentally different interference threat into licensed services than ever existed before.

With respect to the FSS, the potential for interference from unlicensed devices has increased as (i) satellite terminals and unlicensed devices have begun to be used in close proximity to one another, (ii) the use of unlicensed devices outdoors had proliferated, and (iii) the sheer number of unlicensed devices has dramatically increased.

There is a very real practical problem created by the proliferation of unlicensed devices: there is no effective control over the operators of these devices when they cause interference. A licensed user who experiences interference has no sure way of finding the interfering unlicensed user, and even if the licensee finds the unlicensed user there is no way to require the user to shut off. The problem of identifying the offending device is particularly acute in the case of an unlicensed user who operates a mobile or portable device that disrupts the proper operation of a licensed service on an intermittent basis. This inability to control interference from unlicensed users is compounded by the fact that manufacturers of Part 15 devices are not responsible for interference caused by their devices, and Commission rules simply encourage manufacturers to advise users how to solve interference problems that they create.

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[11] *See, e.g., Comments of CWLab.Net* at 20, ET Docket No. 02-135, July 8, 2002; *Comments of Ericsson, Inc.* at 2-3, ET Docket No. 02-135, July 8, 2002; *Comments of The Information Technology Industry Council* at 7, ET Docket No. 02-135, July 8, 2002.

For the reasons provided above, Hughes opposes any effort to establish a "hard limit" on the level of interference that licensed services must accept from Part 15 devices—doing so would constrain future developments in satellite technology. Moreover, as described above, the aggregate power level emitted by multiple terrestrial devices, including unlicensed devices, is a very real problem, particularly as more and more consumers adopt unlicensed devices, such as PDAs, computers, and WiFi, and as those devices are used in closer proximity to licensed users and are designed to transmit over larger distances. Thus, there is no basis for following Xtreme Spectrum's proposal to set specific numeric "maximum permissible emissions levels" for unlicensed devices, and allowing "device[s] operating in compliance with these interference-derived limits [to] enjoy a presumption that [they] are not a source of harmful interference."[12]

As Hughes and other commenters have pointed out in this and other proceedings, unlicensed devices offer potential benefits, but also present a Pandora's Box of possible problems. If the Commission allows unlicensed devices to proliferate in bands used by licensed users without taking suitable precautions to protect these licensed users, there will be no practical way to put the interfering unlicensed users back in the box—neither users of the victim service nor the Commission will be able to find them, and it may not be feasible to require that manufacturers recall the offending devices.

Hughes therefore agrees with those commenters who advocate providing unlicensed devices their own bands to allow their technologies to develop in ways that allows them to co-exist with each other. This may involve the Commission having to make difficult decisions about where these unlicensed devices should go and how they should interrelate with each other, but this is far more preferable than the alternative. As MSTV and the NAB put it:

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12 *Xtreme Comments* at *8*.

> The growth and promise of this field suggest that unlicensed devices continue to need their own designated spectrum, and may indeed need more of it in the future. By the same token, this growth suggests that letting unlicensed devices share bands with licensed services is not a viable long-term, or even short-term, solution. As unlicensed devices proliferate, the level of pollution they cause will increase. By the time this pollution reaches unacceptable levels, it may be too late to restore order without tremendous disruption of investments on the part of consumers and industry, and considerable damage will have occurred in the meantime.[13]

IV. SATELLITE LICENSING ISSUES

In its comments, CTIA suggests that the Commission reallocate satellite spectrum if no satellite operator has applied for the spectrum within one year of its initial allocation, and whenever a satellite licensee fails to meet its construction milestones.[14] The fact that satellite spectrum may be unused at a given time, however, does not mean that it will not be used, or that it should be reallocated.

CTIA simply ignores the distinctions between satellite and terrestrial services and concepts of sound spectrum planning that require spectrum to be set aside for future satellite use even while terrestrial operators would like to have access to that same spectrum. As noted in Hughes' comments, deployment of satellite technology in a given frequency band has historically trailed behind terrestrial operation in that band because of the long lead time required to develop space-qualified hardware in new frequency bands.[15] If a terrestrial wireless operator discovers that it has not designed a network "quite right," it can send out work crews and retrofit

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13 *Joint Comments of The Association For Maximum Service Television, Inc. And The National Association Of Broadcasters,* at 17, ET Docket No. 02-135, July 8, 2002.

14 *Comments of the Cellular Telecommunications and Internet Association* at 13, ET Docket No. 02-135, July 8, 2002 ("*CTIA Comments*").

15 *Hughes Comments* at 4-5.

existing base stations with new equipment using the same spectrum. It is impossible to do the same with space stations in orbit.

Like a well-thought-out master plan for a county, the Commission's Table of Frequency Allocations provides a means for long-term spectrum planning that should not be altered by the fact that some satellite operators have tried and failed. If this were the standard, the Ku band would have been reallocated to the terrestrial fixed service in the mid-to-late 1980's after most (if not all) of the first round Ku band GSO FSS applicants failed to implement their licensed systems. And the Ku band VSAT networks that countless businesses, governments, and consumers rely on every day never would have had a chance to develop. By CTIA's logic, the FCC should have re-reallocated the PCS C-Block back to government use (or to satellite use) back in 1997, when the licensees started to go bankrupt.

Moreover, CTIA's suggestion that the Commission not consider accepting satellite applications until it has promulgated specific service rules[16] runs counter to the nature of satellite technology. Unlike cellular and PCS systems, which run on standard designs and off-the-shelf equipment, satellites are for the most part custom designed, and their operations tend to be, unique. Service rules established in a vacuum, and without the benefit of specific technical proposals before the Commission, would likely invite so many requests for waivers and forbearance that the rules themselves would have little import.

V. CONCLUSION

Given the many important and unique benefits satellite services provide, Hughes urges the Commission to: (i) provide the fixed satellite service (FSS) access to its own spectrum, free from terrestrial interference, (ii) avoid quantifying "harmful interference" in a way that

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16 *CTIA Comments* at 10.

constrains the development of satellite technology, (iii) provide unlicensed users access to their own spectrum bands, separate and apart from the FSS bands, and (iv) take a long term view with respect to its satellite spectrum allocation and licensing decisions.

Respectfully submitted,

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